Influence of Virtual Reality (VR) Product on Consumer Purchase Intention in China

호우위청 (Hou, Yucheng)
동국대 대학원 글로벌비즈니스전공 석사과정, ychou9210@gmail.com

문태수 (Moon, Taesoo)
동국대 경영학부 정보경영학전공 교수, tsmoon@dongguk.ac.kr

Ⅰ. Introduction

With March 26, 2014, the Facebook announced that they will spend 2 billion dollars acquisition of immersive virtual reality technology company VR Oculus. And March 2015 on MWC2015, debut of the virtual reality helmet product HTC Vive gave us a message that virtual reality (VR) began to walk into our vision again, and this time is no doubt a high-profile one. The concept of virtual reality (VR) came to public attention when it first appeared in 1989 by Jaron Lanier. And its specific connotation is: comprehensive utilization of computer graphics systems and various reality and control interface equipment, the computer generated, interactive three-dimensional environment to provide immersive feeling technology.

Virtual reality (VR) is becoming more and more popular in the last two years, especially this year. And some insiders said that 2016 is the first year of virtual reality. According to a report from Super Data Research said that to the end of 2016, the number of users of VR products will reach 38.9 million while the VR market size is expected to reach $5.1 billion. In 2016, VR market size will be 7.7 times higher than it in 2015($660 million) and the analysis also pointed out that in 2017 this number will reach to $8.9 billion. In 2018 it will reach to $12.3 billion. Therefore, the VR market will be a big cake in the future global market.

For China, VR concept has became popular in first-tier cities in 2015. And became more and more popular in science technology, media, and game hardware fields. According to the price of VR glasses is not to expensive to experience it, VR has became popular among young groups. Hence, in China, the pace of expansion of virtual reality industry are speeding up. In accordance with Hou(2016), in 2015, the size of Chinese VR market is 1.48 billion yuan and this number will increase to 6.52 billion yuan in 2016, until 2020 the size of Chinese VR market will grow to 58.95 billion yuan. From the use scale, in 2015, the number of user is only 386 thousand but with the development of the market I twill increase to 6.75 million, and until 2020 the number of user will grow to 28.52million in China. Hence, we can draw that the market of virtual reality product in China also has big opportunity.

Prior studies are almost refers to the realization of virtual reality technology and its

application in specific areas (Kim, 2010; Ohta et al., 2014). However there is not enough studies about the acceptance of VR products in marketing. Hence, with the VR products in the spotlight, this study become more important than before. As we know technology acceptance model (TAM) is a widely accepted theory, proposed by Davis (1989), which identifies any behavioral issues of users in the acceptance of new technologies (Cheng, 2015, Fathema et al., 2015 and Ahn et al., 2007). Therefore, the objective of this study is to apply the TAM to individuals' acceptance and purchase intention of virtual reality product in China.

Ⅱ. Literature review and Theory Development

Before developing our model we review some relevant published literatures. Our review and evaluation of the literature are presented in the following section.

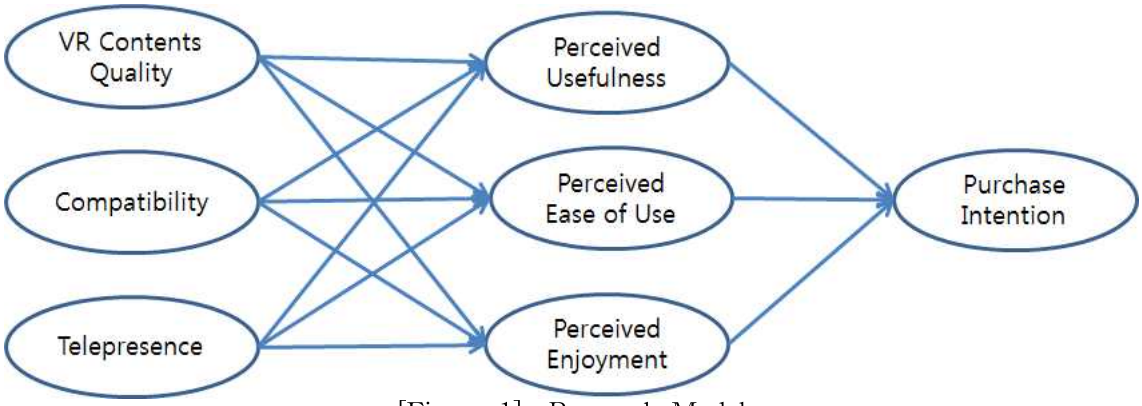
2.1 Technology Acceptance of Virtual Reality (VR)

As Mauro Figueiredo, Klaus BÖhm, and Jose Teixeira defined, in 1993, virtual reality is a computer-generated environment, that gives the illusion of being immersed in a real system. And Steve Bryson (1996) gave another definition about virtual reality, which is the use of computers and human-computer interfaces to create the effect of three-dimensional world containing interactive objects with a strong sense of three-dimensional presence. Difference from the definition in 1993, Bryson emphasize effect not illusion and add three-dimensional into the definition. In other words, it means that VR can simulate physical presence in real places and in imaginary world via three-dimensional of computer-generated.

With the development of information and communication technology, VR has become more realistic, more rapid and more rich graphics. Hence, nowadays, VR not only use for help scientists to gain their understanding of physical process but also use for medical visualization, entertainment, video games, education, and training (Kim,2010; Ohtaetal.,2014). With regard to virtual reality, there are two basic elements are immersion and interaction. Immersion describe the degree of simulation provided to users while defining the depth of involvement and the extent to which the user can feel the reality. It means the depth of telepresence. As for interaction, it allows users not only to receive information from the virtual reality system but also create, control, observe and communicate with system. And in this study we defined virtual reality as a system can create a virtual world which can make users feel telepresence and interact with system.

The basic theoretical framework of Daivs (1989) to study technology adoption behavior is the Theory of Reasoned Action (TRA) which proposed by Fishbein and Ajzen's in 1975. Technology acceptance model (TAM) identifies behavioural issues of users in the acceptance of new technologies. And many studies had already used it to study the users' behavior when a new technology emerge, such as websites usage (Heijden, 2003), mobile learning usage (Cheng, 2015; Almaiah et al., 2016), media tablets (Yu et al.,

2015), e-learning (Mohammadi, 2015), online retailing (Ahn et al., 2007). Hence, we consider the technology acceptance model (TAM) in this study to research the VR products purchase intention of chinese customers. And Figure. 1 depicts the research model and illustrates the hypotheses tested in this research.



[Figure 1] Research Model

2.2 VR content quality

According to Daft and Lengel (1986), suggested that the quality, accuracy, and reliability of the information exchanged across a medium are critical. However, some studies suggested that content refers to information, features, or applications that are offered. Palmer (2003) indicated that in web sites content includes that amount and variety of contents as well as the use of text, graphics, and multimedia. And found out content quality plays an influential role in customers' appraisals of IT. Yu et al. (2015) refers that in media tablets content is defined as the information, features, or applications that are offered in the mobile Web site or application marketplace. And they found out that high content quality positively affect both perceived usefulness and enjoyment. And Almaiah et al. (2016) said that in mobile learning content quality positively affect both perceived usefulness and perceived ease of use. Fathema (2015) suggested that in learning management system the availability of the related resources which means the content has positive effect on perceived ease of use.

On the basis of these results, we can find that the content will has influence on acceptance of new technology, and high quality content will lead to high adopting. In addition, due to the prior studies, we defined the VR content in this study as the information, features, or applications that are offered in the virtual reality application marketplace. And hypotheses as follow:

H1a. The content quality of virtual reality product has positive influence on perceived usefulness.

H1b. The content quality of virtual reality product has positive influence on perceived ease of use.

H1c. The content quality of virtual reality product has positive influence on perceived enjoyment.

2.3 compatibility

According to Rogers said that compatibility refers to perceive to be consistent with the adopters' beliefs, lifestyle, existing values, experience, and current needs, and high compatibility can result in preferable innovation adoption. Some studies (Karahanna et al., 2006; Ozturk et al., 2016; Cheng, 2015; Wu & Wang, 2005; Kim et al., 2013; Chen et al., 2002) have combined the view of TAM with the compatibility construct to explain users' IS/IT acceptance. And in China, there are really many people decide the acceptance of new technology by their lifestyle, experience, and current or potential needs. Hence, we consider the compatibility in this study.

Karahanna et al. (2006) explored three different aspects of compatibility which are existing practices, experience, and values. And the results found that existing practices and experience of compatibility has positively affect perceived ease of use, values and existing practices has positively affect perceived usefulness. Cheng (2015) found that compatibility which include learning style, existing practices of learning has positively influence on perceived ease of use, perceived usefulness, and perceived enjoyment of m-learning acceptance. Ozturk et al. (2016) found that compatibility is also positively affect perceived ease of use in mobile booking system. In addition, Wu and Wang (2005) researched what would determine users' acceptance of mobile commerce and indicated that compatibility is positively affect perceived usefulness.

According to prior studies we can find that compatibility has positively affect perceived usefulness, perceived ease of use, and perceived enjoyment in different fields. Based on prior studies, we defines compatibility as the degree to which virtual reality product refers to purchasers' prior experience, lifestyle, current or potential needs and existing values. And hypotheses as follow:

H2a. The compatibility of virtual reality product has positive influence on perceived usefulness.

H2b. The compatibility of virtual reality product has positive influence on perceived ease of use.

H2c. The compatibility of virtual reality product has positive influence on perceived enjoyment.

2.4 Telepresence

Telepresence, the perception of presence within a physically remote or simulated site, has been identified as a design ideal for synthetic environments (Draper John et al., 1998). And differences in the nature of the computer-mediated environment allow subdivision of SEs into virtual reality systems, teleoperators, and telecommunications. Draper found three definitions of telepresence in commen use: the simple, the cybernetic,

ant the experiential. In simple definition, telepresence as the ability to operate in a computer-mediated environment. In cybernetic definition, telepresence is an index of quality of the human-machine interface. And in experiential definition, telepresence is a mental state in which a user feels physically present with in the computer-mediated environment. Agah and Tanie (1999) indicate technology can produce a telepresence experience as a system that provides the user with the feeling of being present in are mote location through the use of images, sounds, and (at times) touch. In addition, telepresence also be described as the user feel like he is actually present in the environment generated by the computer and forget he is just looking at pixels on a screen (Pace, 2004). Hence, we consider telepresence in this study and use the experiential definition of telepresence which means, in simply words, make users feel "be there".

And in some cases, they found that the higher the level of telepresence, the more real the virtual experience (Klein, 2003; Jee-Sun, 2012). And undoubtedly, the high real virtual experience is necessary for virtual reality product. Hence, we consider telepresence in this study. In addition, Klein (2003) said the content in media, people with a higher level of telepresence are more likely to find the media more useful than those with a lower level of telepresence. Park et al.(2012) also found that in E-tail shopping telepresence which defined as online consumers feel they are real in a physical store positively influence on perceived usefulness. Some studies (Pelet et al., 2015; Weibel et al., 2008; Faiola et al., 2013) have combined the view of perceived enjoyment and telepresence. Pelet(2015) found that in social media telepresence positively affect perceived enjoyment and Weibel et al.(2008) also found that in online games telepresence has positive influence on perceived enjoyment. And some studies(Joo, 2014; Sanchez-Prieto et al., 2016) found that perceived enjoyment positively affect perceived ease of use. As the definition of telepresence It can let you fell "be there", and we believe it can let users feel VR product easy to use and learn, familiar with usage, and easy to get what they want to get from VR product contents. Hence, we also consider that telepresence of VR products positively affect perceived ease of use. And hypotheses as follow:

H3a. The telepresence of virtual reality product has positive influence on perceived usefulness.

H3b. The telepresence of virtual reality product has positive influence on perceived ease of use.

H3c. The telepresence of virtual reality product has positive influence on perceived enjoyment.

2.5 VR and Purchase Intention

According to Davis (1989), perceived usefulness (PU) defined as "the degree to which a person believes that using a particular system would enhance his or her job

performance". And some studies (Almaiah et al., 2016; Mohammadi, 2015; Cheng, 2015; Wu and Wang, 2004; Joo, 2014; Heijiden, 2003; Sanchez-Prieto et al., 2016; Lee et al., 2005) found that perceived usefulness has positive influence on behavioral intention. Almaiah et al.(2016) said that perceives higher usefulness has a stronger attitude for acceptance and behavior intention. Mohammadi(2015) found that the greater perceived usefulness of e-learning system, the more intention to use. Heijiden (2003) found that perceived usefulness has positive influence on behavioral intention to use websites.

Due to Davis (1989), perceived ease of use (PEOU) defined as "the degree to which a person believes that using a particular system would be free of effort". And some studies (e.g. Almaiah et al., 2016; Mohammadi, 2015; Cheng, 2015; Wu and Wang, 2004; Joo, 2014; Lee, 2005) found that perceived ease of use has positive influence on behavioral intention. Almaiah et al. (2016) indicated that perceived ease of use have a significant positive effect on behavioral intention to use mobile learning. Mohammadi (2015) said that in e-learning system field the greater perceived ease of use the more positive behavior intention to use it.

According to Davis (1991), perceived enjoyment (PE) defined as "the extent to which the activity of using the computer is perceived to be enjoyable in its own right, a part from any performance consequences that may be anticipated". And some studies (Cheng, 2015; Joo, 2014; Heijiden, 2003; Lee, 2005) found that perceived enjoyment has positive influence on behavioral intention. As Joo (2014) said that the shopping is a hedonic activity to pursue self-satisfaction. Hence, perceived enjoyment is a key concept to understanding consumers' transaction behavior. Heijiden (2003) found that perceived enjoyment has positive influence on behavioral intention to use websites.

Similarly, VR product also apply via its systems and applications, so we expect that in VR product field if consumers perceive usefulness, perceive ease of use, and perceive enjoyment will have high behavioral intention. In China, there are not enough experience center for people to experience the VR product. And some VR products has low price in China, for example VR glasses which made in China. Hence, we expect that some new consumer maybe purchase low price VR product to experience virtual reality and customers who had already experienced VR because of get greater usefulness, easier use, and higher enjoyment maybe purchase advanced VR product.

According to these and prior studies, we hypotheses as follow:

H4. Perceived usefulness of VR product has positive influence on purchase Intention.

H5. Perceived ease of use of VR product has positive influence on purchase Intention.

H6. Perceived enjoyment of VR product has positive influence on purchase Intention.

Ⅲ. Research Design

The Object of this study is to understand consumers' purchase intention of virtual reality product in China. We designed to conduct an empirical study to test the hypotheses.

3.1 Operational Definition and Measurement

According to previous studies, Table 1. Shows operational definition of each concept and measurements for each variable in this study.

<Table 1> Operational definition of constructs and measurement items

Variables	Operational definition	Measurement	Sources
VR content quality	The degree of the information, features, or applications that can be offered in virtual reality product	I can use various virtual reality contents such as games, movie and travel by Virtual reality product.	Yu et al., 2015
		I can enjoy high quality content on Virtual reality.	
		The more applications on Virtual reality, the better I use it.	
Compatibility	The degree of which virtual reality product refers to consumers' prior experience, lifestyle, current or potential needs and existing values	Using virtual reality product fits well with the way I like to play or work.	Chen et al., 2002; Cheng, 2015; Ozturk et al., 2016; Wu & Wang, 2005
		Using virtual reality product would be consistent with my current preferences.	
		Using virtual reality product would be consistent with my current habits.	
		Using virtual reality product would match my living experience.	
		Using virtual reality product fits my lifestyle.	
Telepresence	The degree of which user feel like he is actually present in the virtual environment via virtual reality products	When I was navigating through the virtual reality product, I forgot about my immediate surroundings.	Pace, 2004; Kim & Hyun, 2016; Faiola et al., 2013; Klein, 2003
		Moving around in the virtual world feels very natural.	
		I felt I was more in the virtual world than the real world around me while I used virtual reality product.	
		The virtual world seemed to me "somewhere I visited" rather than "something I saw".	
		I feel like I am really "there" in the virtual world by virtual reality product.	
Perceived usefulness (PU)	The degree to which consumers believe that using virtual reality product will enhance his or her tasks performance	For me, virtual reality product has great value.	Yu et al., 2015; Yang et al., 2016
		Virtual reality product is useful to my daily life.	
		Virtual reality product provides very useful service and content to me.	
		Virtual reality product can enhance my tasks performance.	
Perceived ease of use (PEOU)	The degree to which consumers believe that using virtual reality product will be effortless	It is easy to learn how to use virtual reality product.	Mohammadi, 2015; Ahn et al., 2007; Chen et al., 2015; Wu & Wang, 2005
		Virtual reality product is easy to use.	
		It is easy for me to become skillful at using virtual reality product.	
		My interaction with virtual reality product is clear and understandable.	
		I find virtual reality product to be flexible to interact with.	
		I would find it easy to get the content what I want to get.	
		Virtual reality product is easy to use anytime and anywhere.	
Perceived enjoyment (PE)	The degree to which activity of using the virtual reality is	Using virtual reality product is truly fun.	Yu et al., 2015; Wu & Wang,
		I spend a killing time by using virtual reality product.	

	perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated.	Compared to other devices, the time spent using virtual reality product is truly enjoyable.	2005
		I can enjoy entertainment using virtual reality product.	
		Using virtual reality product is enjoyable to me.	
		Using virtual reality product would be an ideal recreation.	
		Virtual reality product makes my life more interesting.	
Behavior intention of purchase (PI)	A measure of the strength of consumers intention to purchase	I expect to purchase virtual reality product in the near future.	Heijden, 2003; Mohammadi, 2015; Almaiah et al., 2016
		I will purchase virtual reality product, if useful.	
		I will purchase virtual reality product, if easy to use.	
		I will purchase virtual reality product, if enjoyment.	
		I will purchase virtual reality product, if the charge for virtual reality product is proper.	

3.2 Sampling and Data Collection

We design this study as individual level survey and all responders are chinese consumers who know the virtual reality. The survey is conduct by using E-mail and SNS. A total number between 300 to 400 responses will be collected. The measurements of variables are shown in Table 1. Each measurements are related to a 5-point of the Likert-scale: 1 (strongly disagree) to 5 (strongly agree). Data of the questionnaire will be analyzed by SPSS 20.0 and AMOS 21.0

Ⅳ. Conclusion and Discussion

This study is based on TAM and use VR content quality, compatibility, and telepresence as external variables aim to study the purchase intention of virtual reality product in China and whether each external variables affect perceived usefulness, perceived ease of use, and perceived enjoyment. In this study, we except get results show people are willing to purchase virtual reality product in China. Meanwhile, we can find the reason of consumers purchase virtual reality product in China, and ease of use, usefulness, and enjoyment which has the most significant influence on purchase intention of virtual reality products in China. According to the results, we can give some suggestion to VR product sales organizations such like suggest the most significant influence part for them to use into the advertisement, which age group has the strongest purchase intention of virtual reality product, and so on.

References

Almaiah, M. A., Jalil, M. A., and Man, M., “Extending the TAM to examine the effects of quality features on mobile learning acceptance”, Journal of Computers in Education, Article in Press, 2016.

Ahn, T., Ryu, S., Han, I., “The impact of Web quality and playfulness on user acceptance of online retailing”, Information & Management, Vol.44, No.3, 2007,

pp.263-275.

Bryson, S., “Virtual reality in scientific visualization”, Communications of the ACM, Vol.39, No.5, 1996, pp.62-71.

Chen, L.-D., Gillenson, M. L., and Sherrell, D. L., “Enticing online consumers: an extended technology acceptance perspective”, Information & Management, Vol.39, No.8, 2002, pp.705-719.

Cheng, Y.-M., “Towards an understanding of the factors affecting m-learning acceptance: Roles of technological characteristics and compatibility”, Asia Pacific Management Review, Vol.20, No.3, 2015, pp.109-119.

Davis, F. D., “Perceived usefulness, perceived ease of use and user acceptance of information technology”, MIS Quarterly, Vol.13, No.3, 1989, pp.319-339.

Draper, J. V., David B. Kaber, and John M. Usher, “Telepresence”, Human Factors, Vol.40, No.3, 1998, pp.54-375.

Faiola, A., Newlon, C., Pfaff, M., and Smyslova, O., “Correlating the effects of flow and telepresence in virtual worlds: Enhancing our understanding of user behavior in game-based learning”, Computers in Human Behavior, Vol.29, No.3, 2013, pp.1113-1121.

Fathema, N., Shannon, D., and Ross, M., “Expanding the technology acceptance model (TAM) to examine faculty use of learning management systems (LMSs) in Higher Education Institutions”, MERLOT Journal of Online Learning and Teaching, Vol.11, No.2, 2015, pp.210-232.

Figueiredo, M., BÖhm, K., and Teixeira, J., “Advanced interaction techniques in virtual environments”, Computers & Graphics, Vol.17, No.6, 1993, pp.655-661.

Heijden, H. V. D., “Factors influencing the usage of wesites: the case of a generic in The Netherlands”, Information & Management, Vol.40, No.6, 2003, pp.541-549.

Hou, C., “Analysis of the development of the virtual reality industry in 2015”, China Internet, Vol., No4, 2016, pp.51-54.

Joo, J., “Exploring Korean Collegians’ Social Commerce Usage: Extending Technology Acceptance Model with Word-of-Mouth and Perceived Enjoyment”, Journal of Digital Covergence, Vol.12, No.8, 2014, pp.147-155.

Karahanna, E., Agarwal, R., and Angst, C. M., “Reconceptualizing compatibility beliefs in technology acceptance research”, MIS Quarterly, Vol.30, No.4, 2006, pp.781-804.

Kim, G.-M., Kim, K., and Lee, H., “The structure of compatibility beliefs in mobile entertainment service adoption”, Journal of information technology applications & management, Vol.20, No.1, 2013, pp.217-240.

Kim, H.-C., and Hyun, M. Y., “Predicting the use of smartphone-based Augmented Reality (AR): Does telepresence really help?”,Computers in Human Behavior, Vol.59, 2016, pp.28-38.

Kim, J.-J., “Virtual reality application on MFL gas pipeline inspection system”, Journal of the Korea Indutrial Information System Research, Vol.15, No.4, 2010, pp.47-52.

Klein, L. R., “Creating virtual product experiences: the role of telepresence”, Journal of interactive marketing, Vol.17, No.1, 2003, pp.41-55.

Lee, H.-H., Fiore, A. M., and Kim, J., “The role of the technology acceptance model in explaining effects of image interactivity technology on consumer responses”, International Journal of Retail & Distribution Management, Vol.34, No.8, 2006.

Mohammadi, H., “Investigating users’ perspectives on e-learning: An integration of TAM and IS success model”, Computers in Human Behavior, Vol.45, 2015, pp.359-374.

Ohta, M., Otani, H., and Yamashita, K., “Photo-based desktop virtual reality system implemented on a web-browser”, IEIE Transactions on Smart Processing & Computing, Vol.3, No.2, 2014, pp.88-95.

Ozturk, A. B., Bilgihan, A., Nusair, K., and Okumus, F., “What keeps the mobile hotel booking users loyal? Investigating the roles of self-efficacy, compatibility, perceived ease of use, and perceived convenience”, International Journal of Information Management, Article in Press, 2016.

Pace, S., “A grounded theory of the flow experiences of Web users”, Internation Journal of Human-Computer Studies, Vol.60, No.3, 2004, pp.327-363.

Palmer, J. W., “Web site usability, design, and performance metrics”, Information Systems Research, Vol.13, No.2, 2002, pp.151-167.

Park, J.-S., Hyun, J., Fairhurst, A., and Lee, K.-H., “Perceptions of Presence as Antecedents to E-tail Shopping - An Extended Technology Acceptance Model -”, The Research Journal of the Costume Culture, Vol.20, No.3, 2012, pp.451-462.

Pelet, J.-E., Ettis, S., and Cowart, K., “Optimal experience of flow enhanced by telepresence: Evidence from social media use”, Information & Management, Article in Press, 2016.

Sanchez-Prieto, J. C., Olmos-Miguelanez, S., Garca-Penalvo, F. J., “Informal tools in formal contexts: Development of a model to assess the acceptance of mobile technologies among teachers”, Computers in Human Behavior, Vol.55, 2016, pp.519-528.

Weibel, D., Wissmath, B., Habegger, S., Steiner, Y., and Groner, R., “Playing online games against computer- vs. Human-controlled opponents: Efects on presence, flow, and enjoyment”, Computers in Human Behavior, Vol.24, No.5, 2008, pp.2274-2291.

Wu, J.-H., and Wang, S.-H., “What drives mobile commerce? An empirical evaluation of the revised technology acceptance model”, Information & Management, Vol.42, No.5, 2005, pp.719-729.

Yang, H., Yu, J., Zo, H., and Choi, M., “Useracceptanceofwearabledevices:An extended perspective of perceived value”, Telematics and Informatics, Vol.33, No.2, 2016, pp.256-269.

Yu, J., Lee, H., Ha, I., and Zo, H., “User acceptance of media tablets: An empirical examination of perceived value”, Telematics and Informatics, Article in Press, 2015.